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भाग 1 आयाम, सामग्री और परीक्षण क्रियाविधि — विशिष्टि

Indian Standard

HOROLOGY — MINERAL AND SAPPHIRE GLASS FOR WRIST WATCH CASES

PART 1 DIMENSIONS, MATERIAL AND TEST PROCEDURES — SPECIFICATION

ICS 39.040.10

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

December 1998

Price Group 2

Horology Sectional Committee, LM 23

FOREWORD

This Indian Standard (Part 1) was adopted by the Bureau of Indian Standards, after the draft finalized by the Horology Sectional Committee had been apporoved by the Light Mechanical Engineering Division Council.

This standard specifies the types of the watch glasses used in horological industries. It also specifies the dimensional and the material requirements along with the test procedure for flat watch glasses to be used on wrist watches.

This standard is being published in two parts as follows:

Part 1 Dimensions, material and test procedures

Part 2 Gasket dimensions, material and test procedures

In the preparation of this standard necessary assistance has been derived from NIHS 61-10, issued by the Normes De L'Industrie Horlogere, Suisse.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

HOROLOGY — MINERAL AND SAPPHIRE GLASS FOR WRIST WATCH CASES

PART 1 DIMENSIONS, MATERIAL AND TEST PROCEDURES — SPECIFICATION

1 SCOPE

This standard (Part 1) specifies the dimensional requirement, material and test procedure for flat mineral and sapphire glass for wrist watch cases.

2 REFERENCE

The following Indian Standard contains provision which through reference in this text, constitutes provisions of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard given below:

IS No.	*Title*
3073 : 1967	Assessment of surface roughness

3 TERMINOLOGY

See Fig. 1.

4 DIMENSIONS

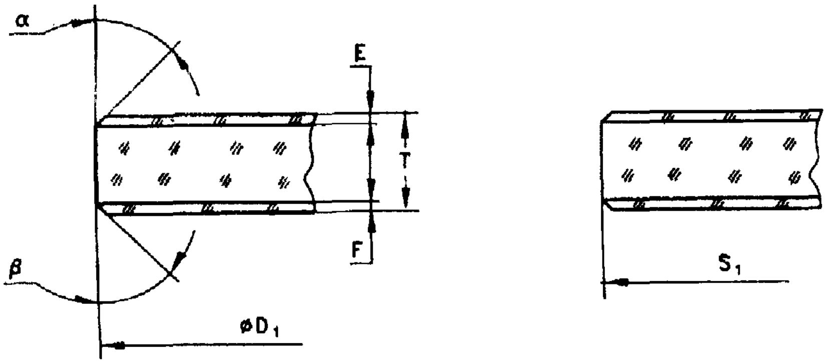
4.1 Sizes

The standard sizes of the mineral and sapphire glass shall be from dia 8.00 mm to dia 35.00 mm in steps of 0.5 mm for round glass, with a tolerance of ± 0.02 mm. In the case of shaped glasses the size and tolerance shall be as agreed upon between the supplier and the customer. The thickness and the chamfer dimensions shall be as specified in Tables 1, 2 and 3.

Table 1 Mineral Glass Thickness and Chamfer Heights

All dimensions in millimetres.

Item	Tolerance	Dimensions			
T	+0.10 −0.00	0.60	0.80	1.00	1.20
E	±0.05	0.10	0.15	0.15	0.15
F	±0.05	0.10	0.15	0.20	0.30



TYPE A (ROUND)

TYPE B (SHAPED)

Symbol	*Description*
D_1	Outside diameter of the glass
S_1	Outside profile of the glass
T	Thickness of the glass
E	Chamfer height of the glass upper side
F	Chamfer height of the glass lower side
α	Chamfer angle of glass upper side
β	Chamfer angle of glass lower side

FIG. 1 DETAILS OF DESIGNATION

Table 2 Sapphire Glass Thickness and Chamfer Heights

(*Clause* 4.1)

All dimensions in millimetres.

Item	Tolerance	Dimensions						
T	+0.10 –0.00	0.4	0.5	0.6	0.7	0.80	1.00	1.20
E	+ 0.00 –0.05	0.15	0.15	0.15	0.15	0.15	0.20	0.20
F	+ 0.00 –0.05	0.20	0.20	0.20	0.20	0.25	0.25	0.25

Table 3 Mineral and Sapphire Glass Chamfer Angles

(*Clause* 4.1)

Item	Tolerance	Glass Thickness, mm						
		0.4	0.5	0.6	0.7	0.8	1.0	1.2
		Angles						
α	± 5°	45°	45°	45É	45°	45°	45°	45°
β	± 5°	35°	35°	35É	35°	35°	35°	35°

5 GENERAL REQUIREMENTS

5.1 Requirements of Finish for Mineral and Sapphire Glass

Mineral glass of drawn sheets shall be ground for N6 finish (*see* IS 3073) as shown in Fig. 2. Top and bottom surface and upper bevel shall be lapped to N3 (*see* IS 3073) finish. The mineral glass to be toughned.

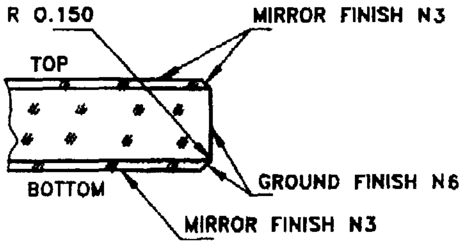


FIG. 2 REQUIREMENT OF FINISH

5.2 Glass Material

5.2.1 *Composition of Mineral Glass*

Mineral glass shall be of sodium silicate glass of the either of the following composition :

a)	Calcium oxide	5 to 7 percent
	Magnesium oxide	4 to 5 percent
	Sodium oxide	13.50 to 15 percent
	Potassium oxide	0.05 to 1.50 percent
	Titanium oxide	0.05 to 0.08 percent
	Zinc	0.01 to 0.03 percent
	Silica	Balance
b)	Calcium oxide	7 percent
	Sodium oxide and Potassium oxide	17 percent
	Titanium oxide	1 percent
	Zinc oxide	4 percent
	Antimony oxide	1 percent
	Barium oxide	2 percent
	Silica	Balance

5.2.2 *Composition of Sapphire Glass*

Sapphire glass shall be of 99.9 percent Aluminium oxide (Al_2O_3).

5.2.3 *Density*

Density of mineral glass shall be : 2.5 to 2.7 g cm^{-3}.
Density of sapphire glass shall be : 3.8 to 3.9 g cm^{-3}.

5.3 Physical Properties

The mineral and sapphire glass shall be clear transparent to the visible light.

5.4 Defects

The mineral and sapphire glass shall be free from the following defects:

Sl No.	*Nature of Defect*	*Remarks*
i)	Breakage, chip off of edges, etc	Not permitted
ii)	Continuous and discontinuous grooves at the sides, rough or broken — whose width and depth may be irregular, scratches, dents, etc	do
iii)	Superficial defects, visible on significant surfaces at an angle only	Shall not be visible to naked eye in day light
iv)	Surface defects, surface crack (punctured defect), etc	Not permitted
v)	Localized defects due to chemical attack, deposits, stains, dust, etc	As per Sl No. (iii)
vi)	Bubbles, accumulation of small bubbles and crystallization defects. Multiple defects of any nature caused by polishing method, which reflects on the whole surface as local uneveness.	Not permitted

5.5 Method for Checking the Glass Defects

The checking shall be carried out in a dark work place, to prevent all stray natural or artificial light which may influence the result of inspection.

Two pencil lamps of 1 500 lux shall be placed in horizontal and vertical positions as shown in Fig. 3 and the verification methods shall be as given in Table 4.

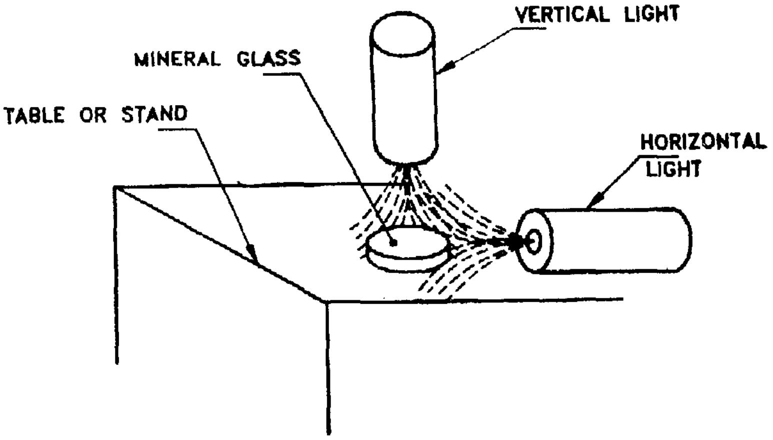


FIG. 3 SETUP FOR CHECKING GLASS DEFECTS

Table 4 Verification Methods

(*Clause* 5.5)

Method	Requirement Levels				Horizontal and Then Vertical Lights Separately
	Colour at the Bottom of the Enclosure		Diffusion of the Light Ray		
	Black	White	Hori-zontal	Verti-cal	
1	X				X
2	X		X (simultaneously)	X	
3	X			X	
4		X	X (simultaneously)	X	
5		X		X	

5.6 Hardness

Vickers and Knoop hardness shall be as given below.

5.6.1 *For Mineral Glass*

a) 550 to 650 HV using a Vickers Hardness Tester

b) 500 to 600 HK using a Knoop Hardness Tester.

5.6.2 *For Sapphire Glass*

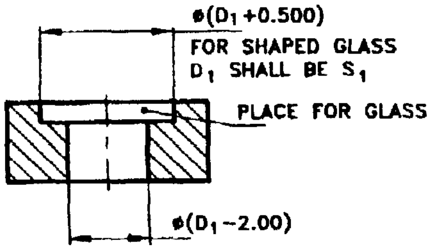
2 000 to 2 500 HK using a Knoop Hardness Tester.

6 MINERAL GLASS TOUGHNESS TEST

6.1 Testing Procedure

The test set up consists of a brass block as shown in Fig. 4 and a testing device as shown in Fig. 5.

The ball shall be centered by means of a brass cone and retained in the position by a magnet or electromagnet without direct contact with the ball, or



All dimensions in millimetres.

FIG. 4 BRASS BLOCK

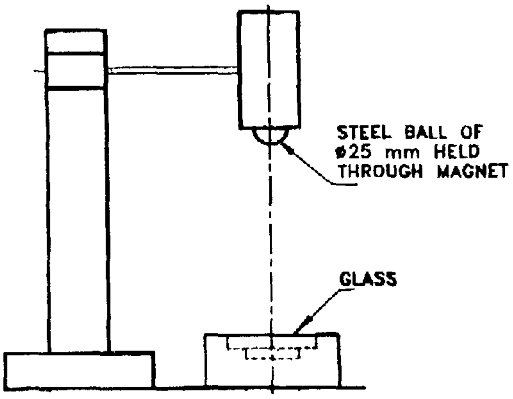
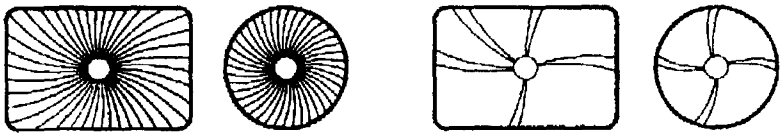


FIG. 5 TESTING DEVICE



ACCEPTED
(LINES 20 AND ABOVE)

REJECTED
(LINES 19 AND BELOW)

FIG. 6 PATTERN OF RUPTURES

any other suitable mechanism. The diameter of the ball used shall be 25 mm and weight 0.635 N.

The following may be taken care of before conducting the test:

a) Verify the position of the ball and release from the farther most point and falls to the center of the glass kept on brass block as shown in Fig. 4 and Fig. 5.
b) Place the mineral or sapphire glass on brass block in which the seating provision for glass is provided as shown in Fig. 4.
c) Conduct initial test in which the glass shall not break or rupture.
d) Conduct series of successive tests by increasing the height by 25 mm, till glass ruptures (breaks). The energy of the rupture is the product of weight of ball and the height of drop at which the glass ruptures.

Energy in Newton metre = $W \times H$

where

W is the weight of the ball in Newton, and
H is the drop height of the ball in metre.

6.2 Criteria for Acceptance

a) The product of energy shall be within 100 to 210 N.mm.
b) The pattern of rupture shall be as given in Fig. 6 .

7 SCRATCH RESISTANCE TEST

Mineral or sapphire glass has to be fixed in a suitable locator. A diamond tool of included angle 120° to be lowered on to the glass surface so that the tip just touches the top surface. A load of 0.15 to 0.25 Newton is then applied on the tool. Tool is moved uniformly at an about 50µm/s. Five grooves of 10 mm length are made on the top surface of the glass. The width of the grooves obtained shall be within the values given in Table 5.

Table 5 Scratch Groove Width
(*Clause* 7)

Load (N)	Groove Width (µm)	
	For Mineral Glass	For Sapphire Glass
0.15	5.7 to 6.7	1.3 to 2.0
0.25	7.8 to 8.8	2.6 to 3.4

8 PACKING

The glasses shall be wrapped in tissue paper and then packed in quantities not exceeding 100 pieces, in suitable packages to avoid deterioration during transportation. The quantity, thickness and designation of the material shall be shown on the outside of each package or as agreed to between the purchaser and the supplier.

9 MARKING

9.1 Each package shall be marked with the manufacturer's name or trade-mark, if any, type, size, thickness and quantity to ensure proper indentification.

9.2 BIS Certification Marking

The product may also be marked with the Standard Mark.

9.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

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Amendments Issued Since Publication

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